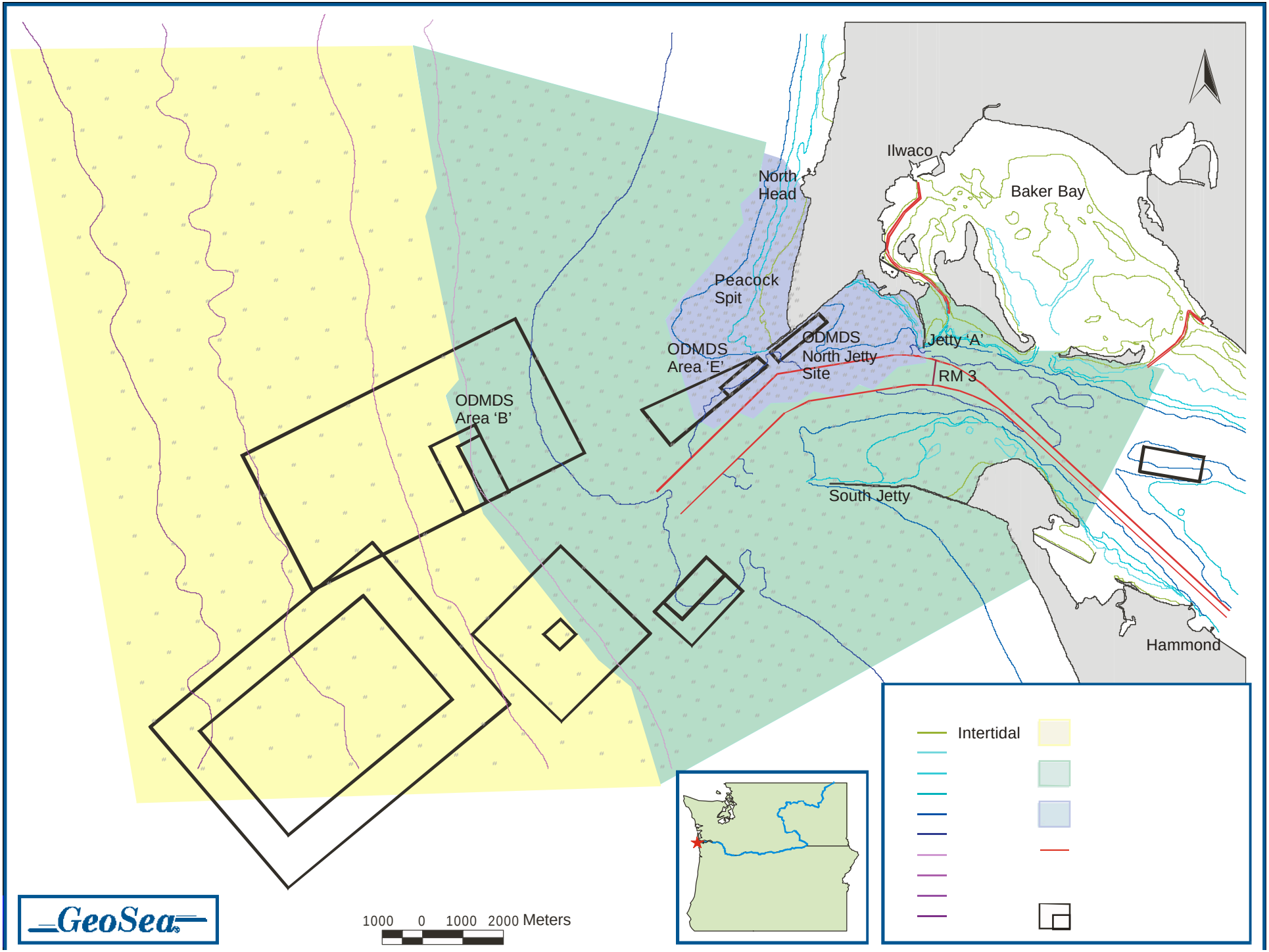
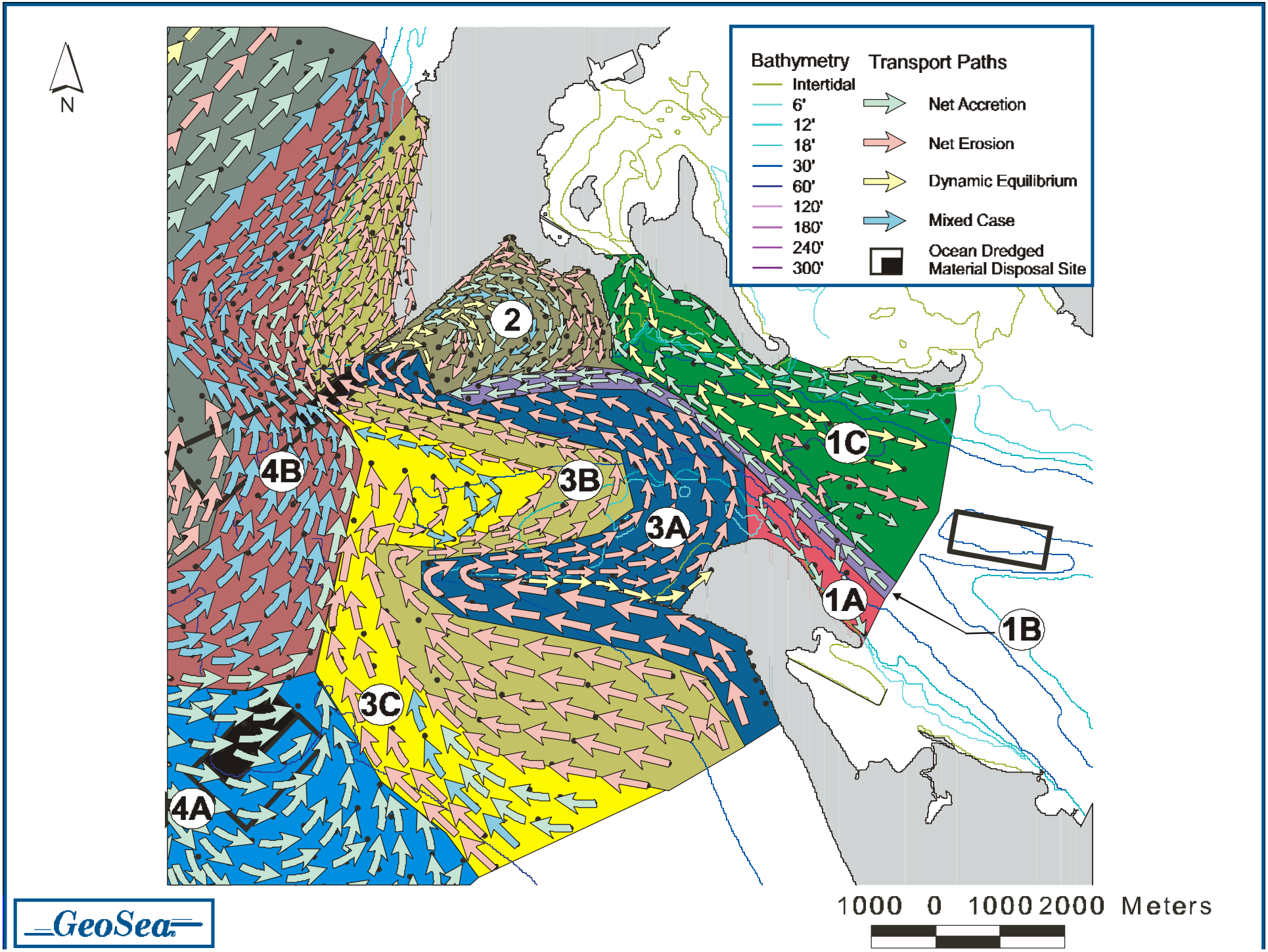
SEDIMENT TREND ANALYSIS (STA®) IN CONTAMINANT MANAGEMENT ISSUES

Patrick McLaren

GeoSea Consulting (Canada) Ltd.


Ilwaco
North Head
Baker Bay
Peacock Spit
ODMDS Area 'E'
ODMDS North Jetty Site
Jetty 'A'
RM 3
ODMDS Area 'B'
South Jetty
Hammond
Intertidal
1000 0 1000 2000 Meters
GeoSea


N
Bathymetry
Intertidal
6'
12'
18'
30'
60'
120'
180'
240'
300'
Transport Paths
Net Accretion
Net Erosion
Dynamic Equilibrium
Mixed Case
Ocean Dredged Material Disposal Site
2
1C
4B
3B
3A
1A
1B
3C
4A
1000 0 1000 2000 Meters
GeoSea

STA TELLS YOU TWO THINGS

- THE NET SEDIMENT TRANSPORT PATHWAYS IN ANY SEDIMENTARY ENVIRONMENT
- THE DYNAMIC BEHAVIOR OF THE BOTTOM SEDIMENTS (NET EROSION, ACCRETION, DYNAMIC EQUILIBRIUM ETC.)

W H Y I S S T A U S

- EXPLAINS HOW THE ENVIRONMENT IS WORKING

(N.B.- STA is not a model)

WHAT ARE THE DATA?

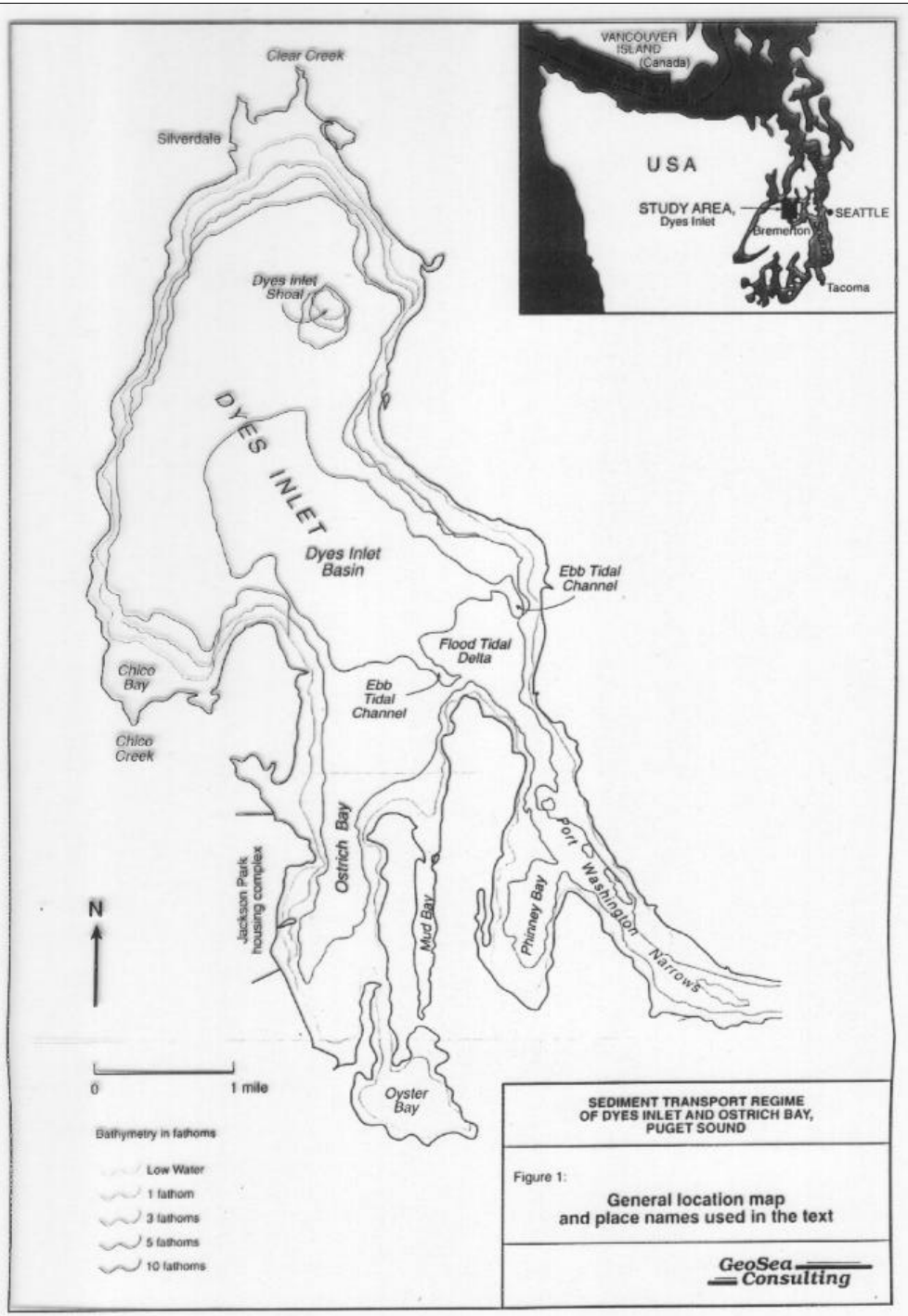
- COMPLETE GRAIN-SIZE DISTRIBUTIONS OF BOTTOM SEDIMENTS

SO YOU WANT TO KNOW THE THEORY?

- NOT HERE - MAYBE LATER
- BUT GO TO **W W W . G E O S E A .** TO OBTAIN THE COMPLETE THEORY PAPER

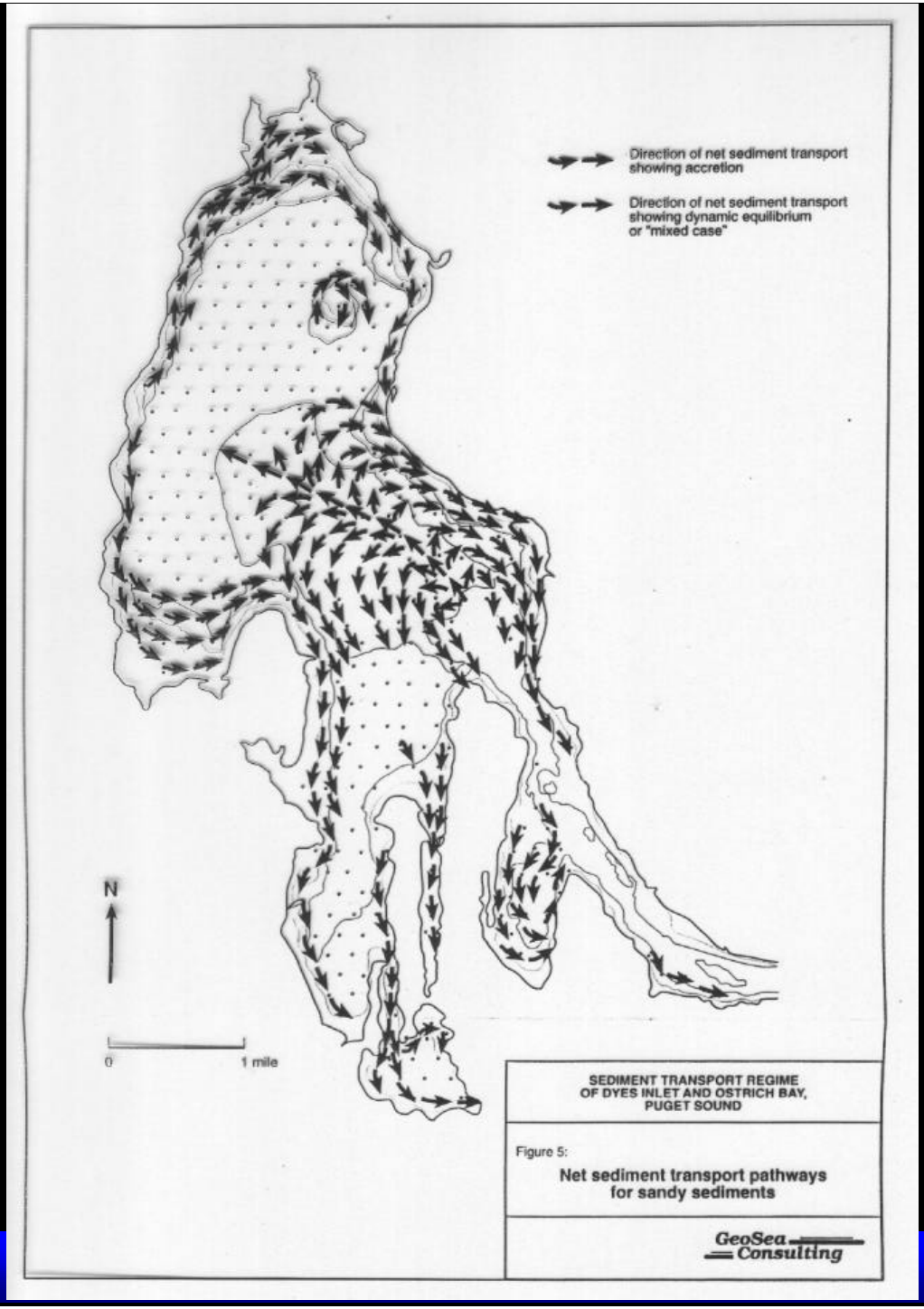
EXAMPLE 1: DYES INLET, WASHINGTON

- Client: US Navy
- Purpose: To cleanup or not to cleanup?

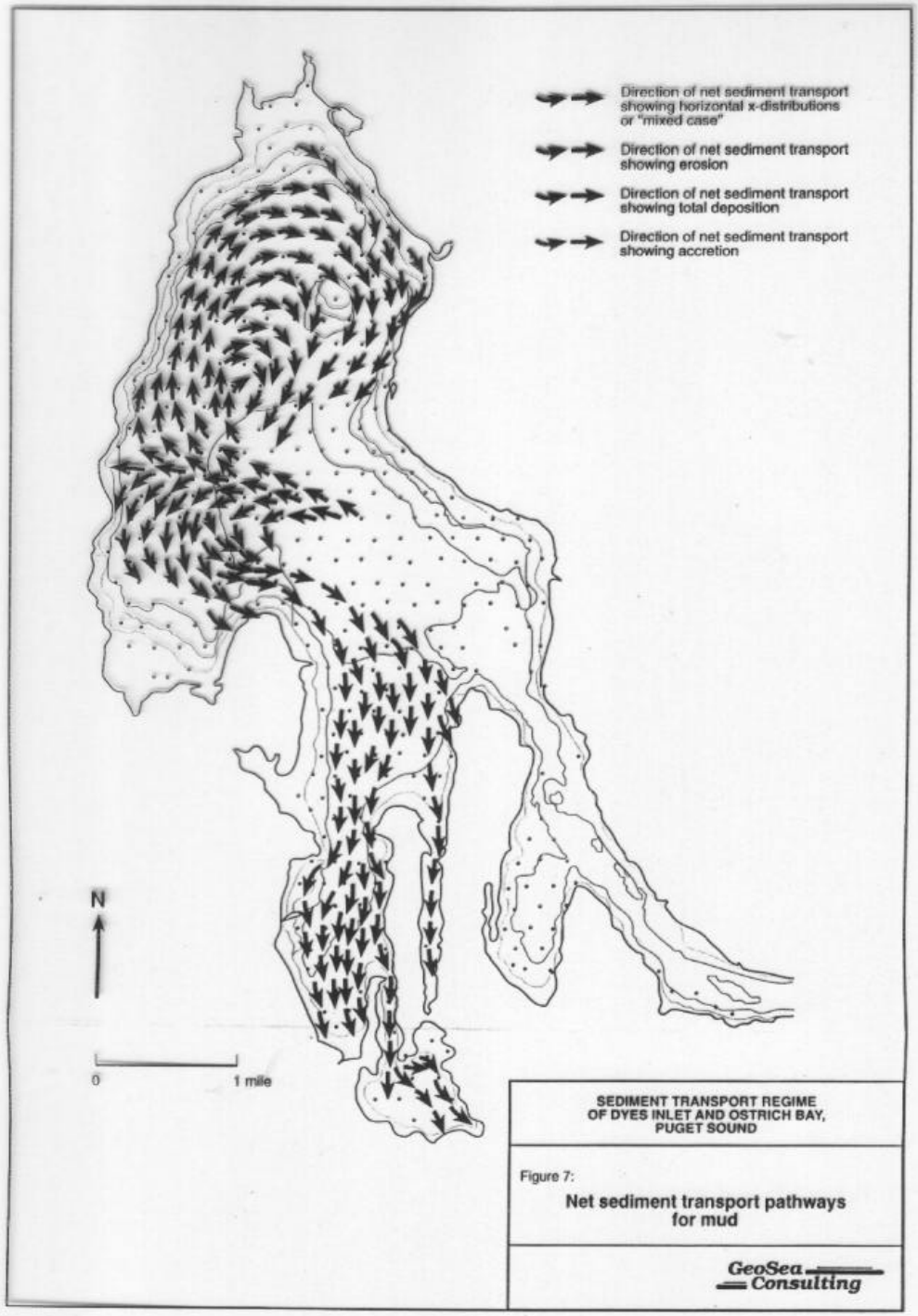

Clear Creek
Silverdale
Dyes Inlet Shoal
DYES INLET
Dyes Inlet Basin
Ebb Tidal Channel
Flood Tidal Delta
Chico Bay
Chico Creek
Ebb Tidal Channel
Jackson Park housing complex
Ostrich Bay
Mud Bay
Phinney Bay
Fort Washington Narrows
Oyster Bay
N
0
1 mile
Bathymetry in fathoms
Low Water
1 fathom
3 fathoms
5 fathoms
10 fathoms
VANCOUVER ISLAND (Canada)
USA
STUDY AREA, Dyes Inlet
SEATTLE
Bremerton
Tacoma
SEDIMENT TRANSPORT REGIME OF DYES INLET AND OSTRICH BAY, PUGET SOUND
Figure 1:
General location map and place names used in the text
GeoSea Consulting

GeoSea

GeoSea


Direction of net sediment transport showing accretion
Direction of net sediment transport showing dynamic equilibrium or "mixed case"
N
0
1 mile
SEDIMENT TRANSPORT REGIME OF DYES INLET AND OSTRICH BAY, PUGET SOUND
Figure 5:
Net sediment transport pathways for sandy sediments
GeoSea Consulting

GeoSea


Direction of net sediment transport showing horizontal x-distributions or "mixed case"
Direction of net sediment transport showing erosion
Direction of net sediment transport showing total deposition
Direction of net sediment transport showing accretion
N
0
1 mile
SEDIMENT TRANSPORT REGIME OF DYES INLET AND OSTRICH BAY, PUGET SOUND
Figure 7:
Net sediment transport pathways for mud
GeoSea Consulting

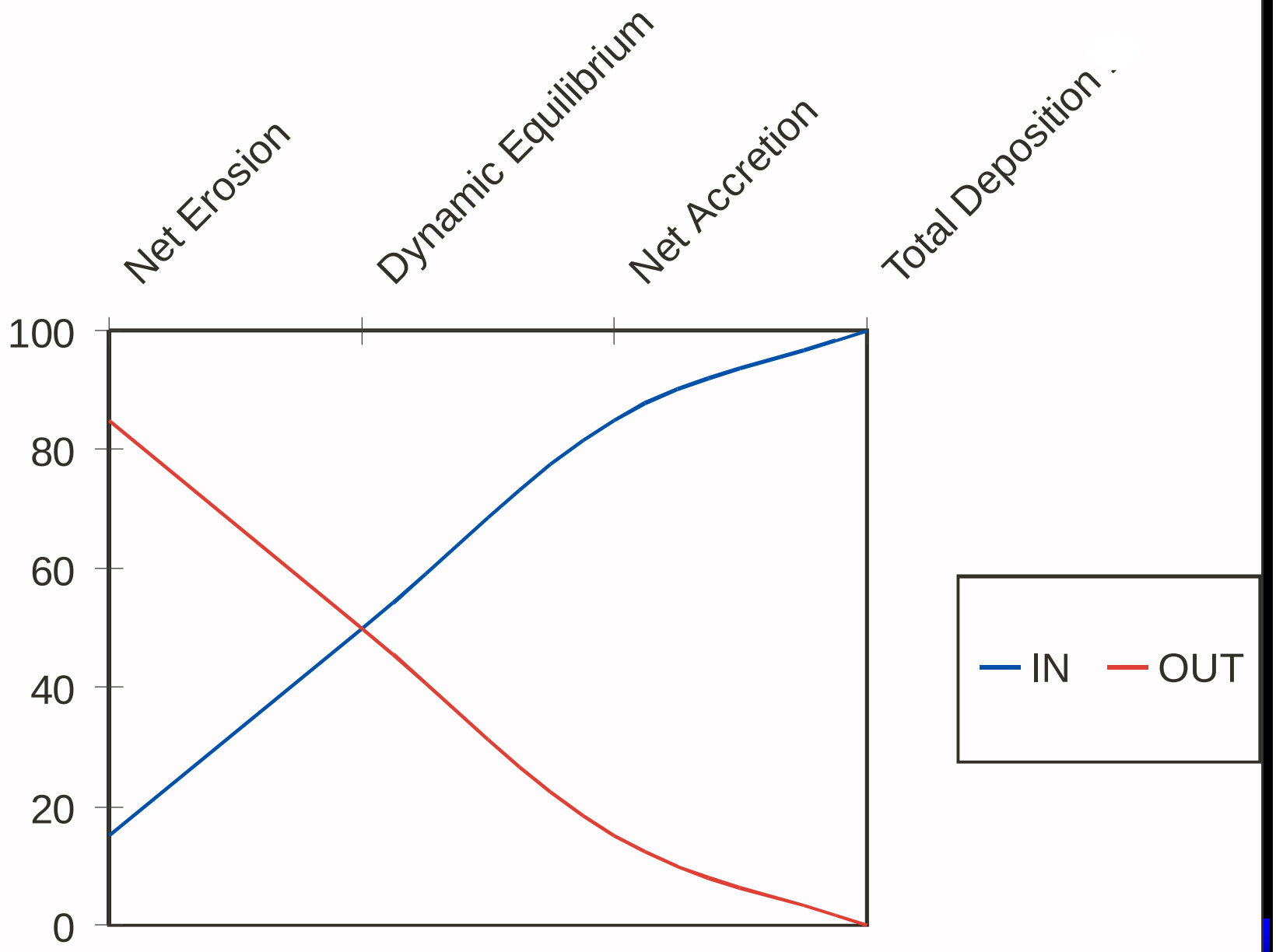
GeoSea

CONCLUSIONS

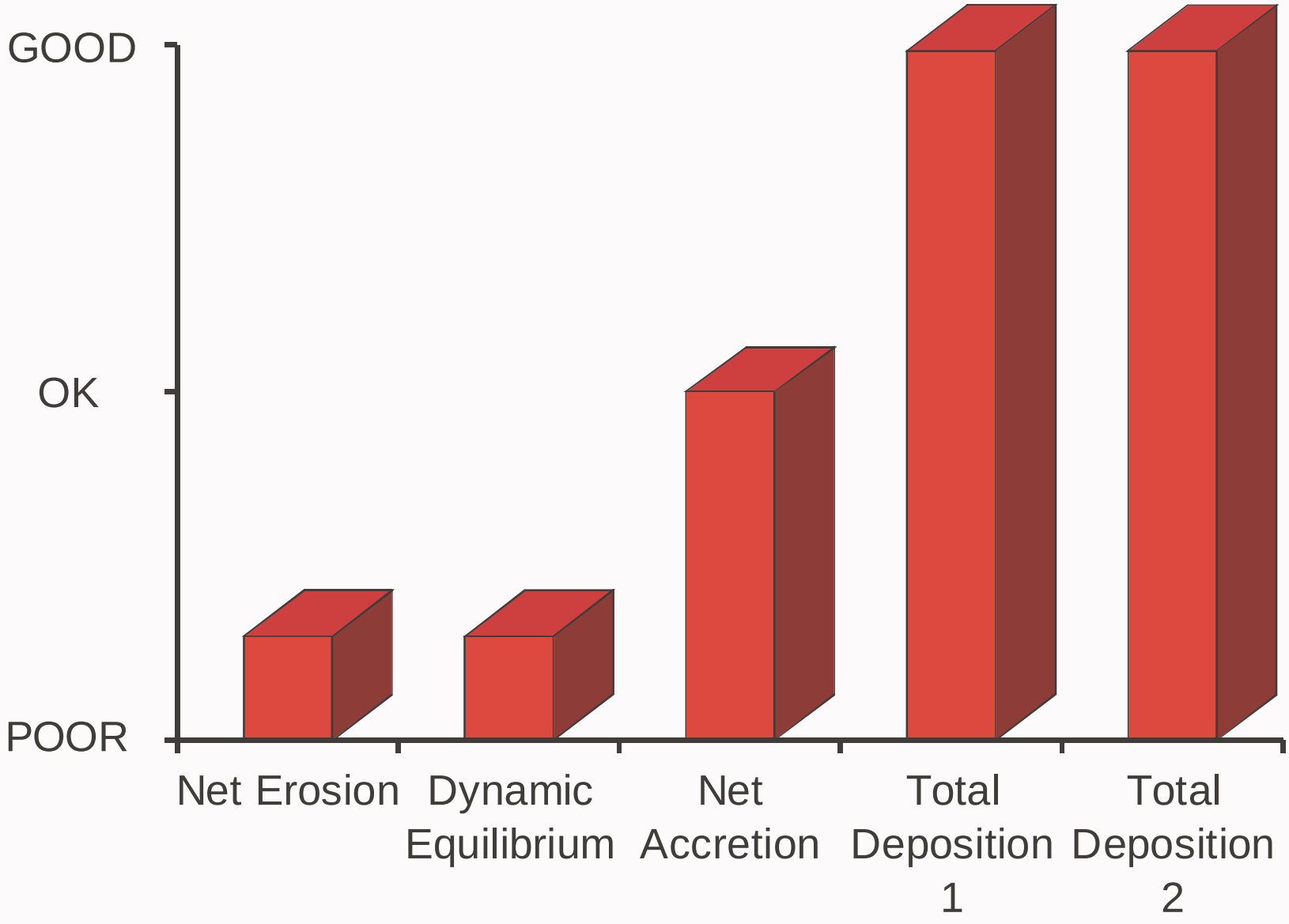
- Present hotspots aren’t going anywhere.
- Incoming mud comes from afar and may be contaminated.
- Contaminant levels throughout Dyes Inlet will more or less be equal.
- Stakeholders have agreed that remedial alternatives can be implemented only after the toxicity of depositing sediment is shown to decrease.

STA – IMPLICATIONS FOR REMEDIATION

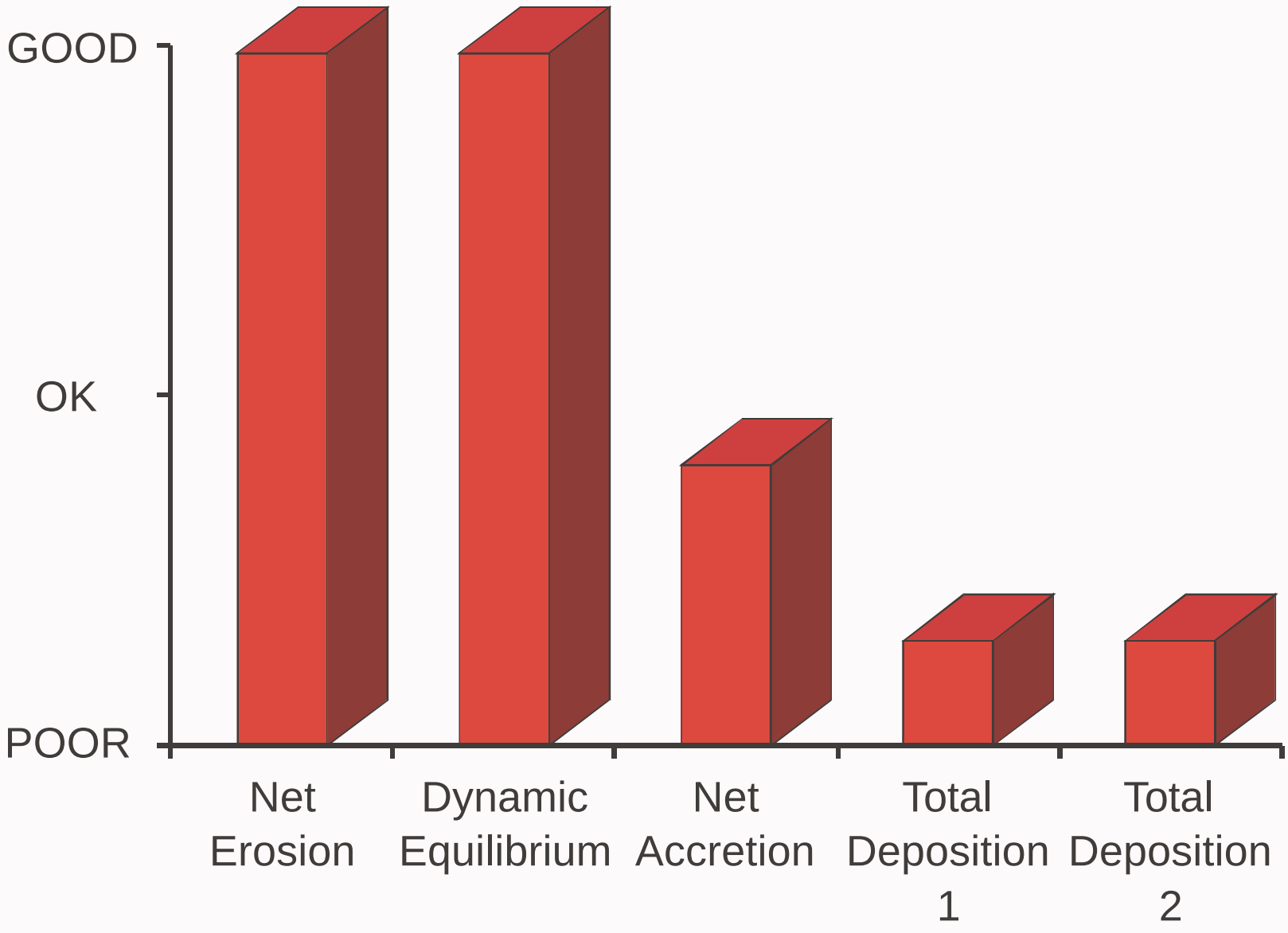
IDENTIFIES WHICH SOURCES ARE CONTAMINATING WHICH ENVIRONMENTS


Net Erosion
Dynamic Equilibrium
Net Accretion
Total Deposition
100
80
60
40
20
0
IN
OUT

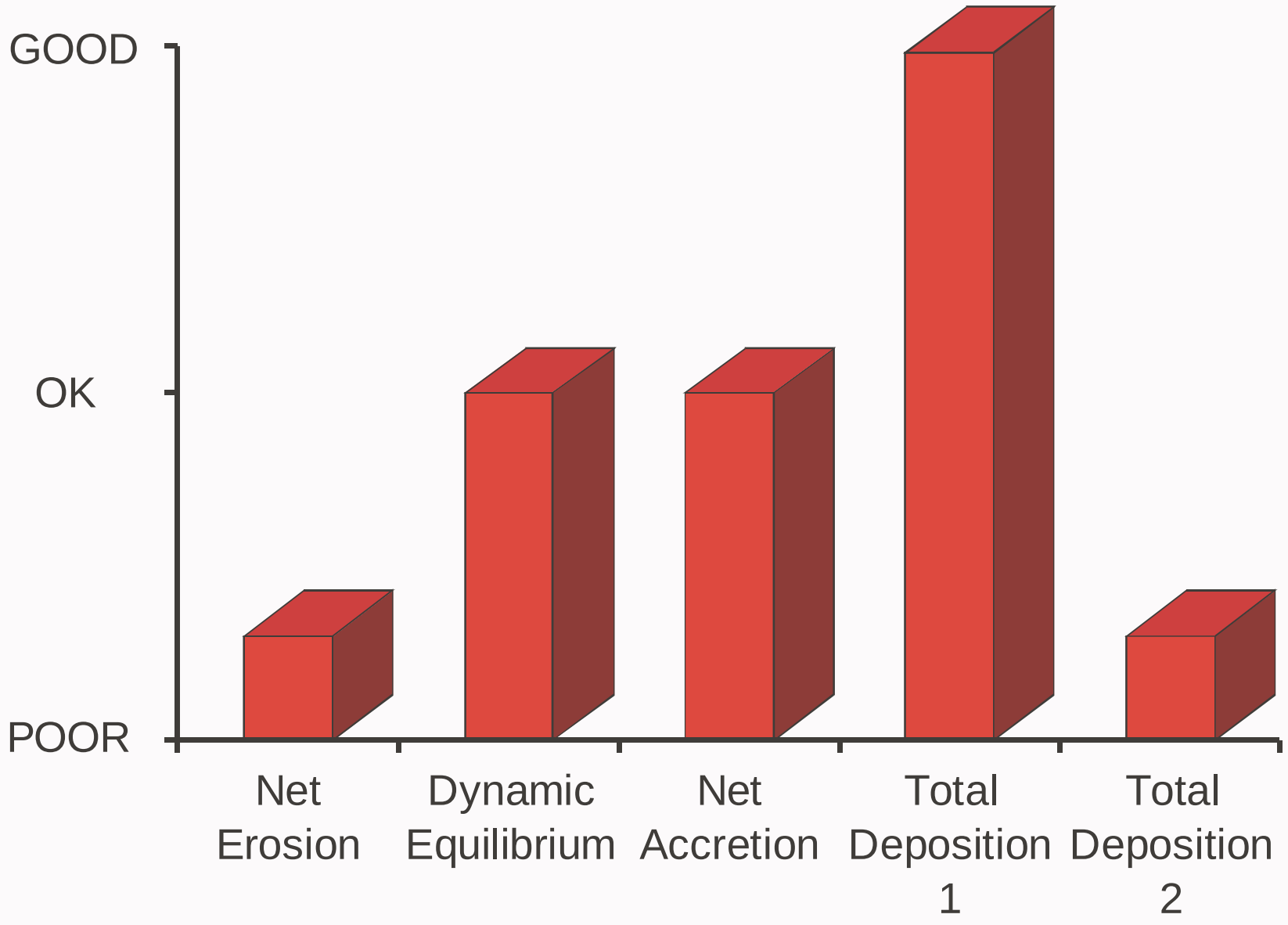
Environmental Monitoring



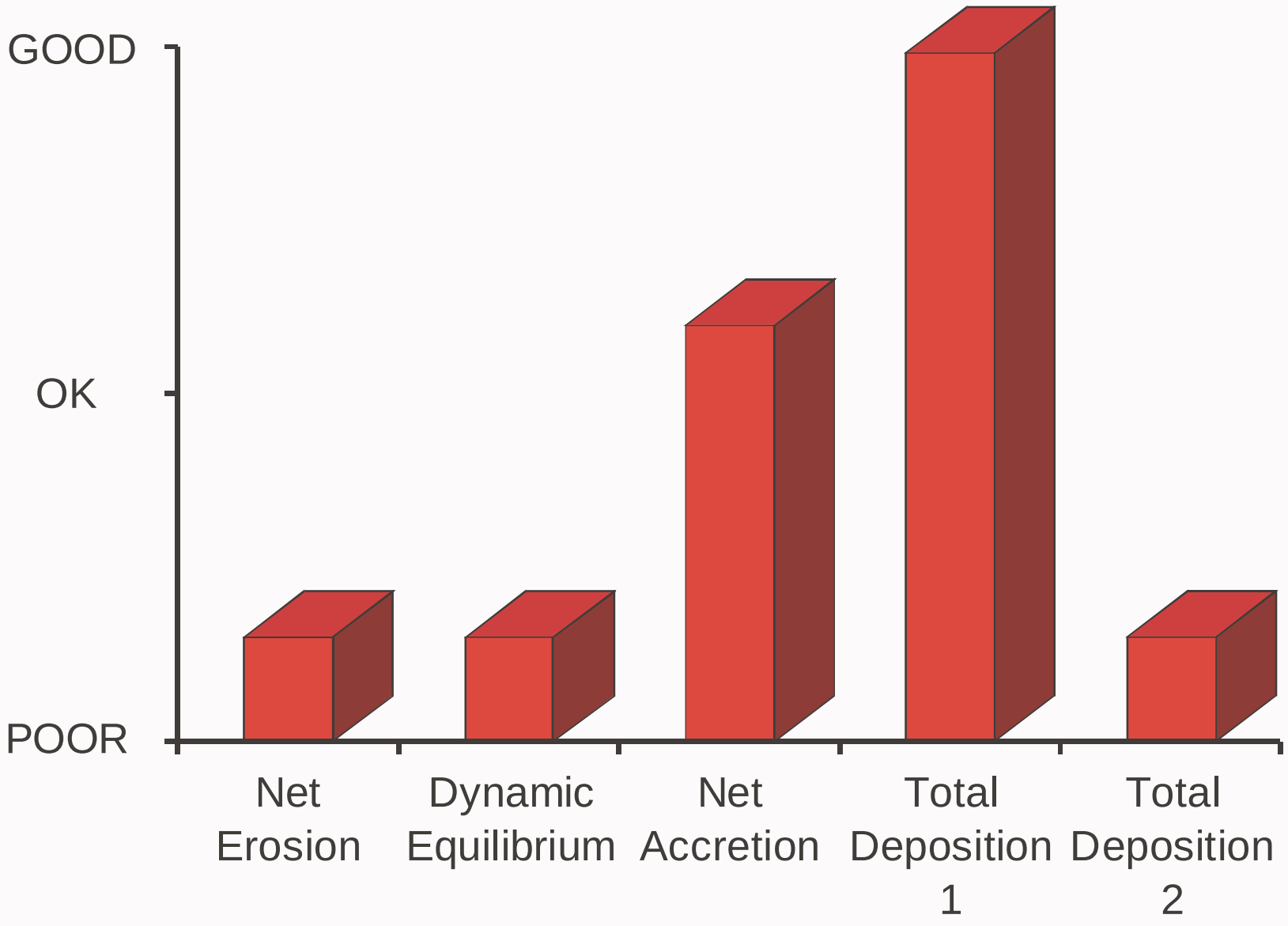
Capping to Hold in Place



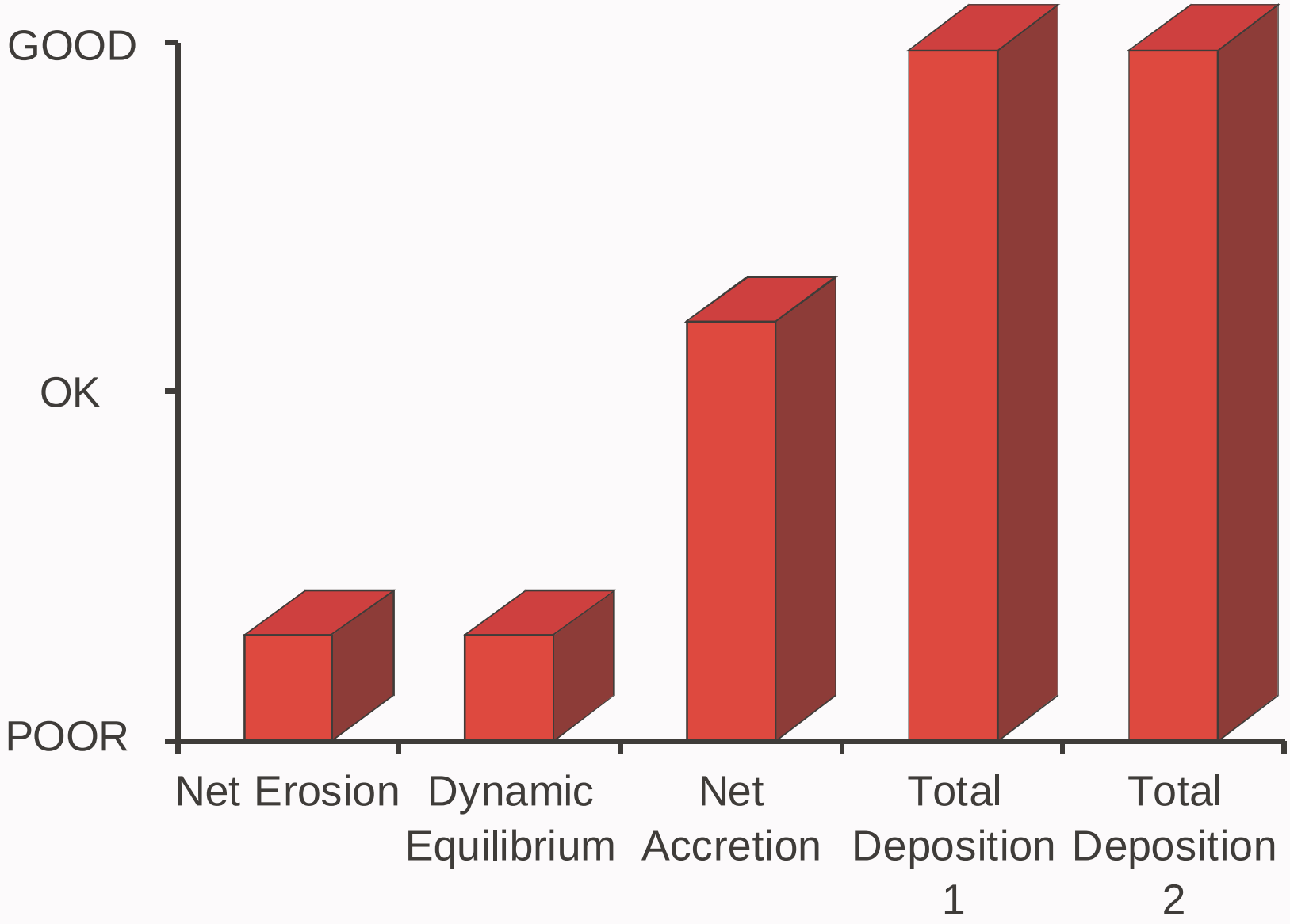
Capping for Isolation



Dredging


GOOD
OK
POOR
Net Erosion
Dynamic Equilibrium
Net Accretion
Total Deposition 1
Total Deposition 2

Do Nothing


GOOD
OK
POOR
Net Erosion
Dynamic Equilibrium
Net Accretion
Total Deposition 1
Total Deposition 2

SUMMARY

- Data are cheap and easy to obtain.
- The sediments themselves act as a tracer.
- Transport pathways integrate all processes without making any assumptions.
- Establishes relationships among all environments (e.g., offshore, intertidal, beach etc.)

- Enables an understanding of the probable processes that are involved before implementing model studies. Provides a method to validate and use models effectively.
- Identifies which sources are contaminating which environments.
- Explains the fate and behavior of contaminants contained in the sediments, and the implications of cleanup options. Locates where the most effective monitoring should be undertaken.
- Can be used to locate new channels for dredging and best areas for disposal sites.

- Can determine the behavior of existing disposal sites.
- STA frequently “discovers” unsuspected problems that may require action.
- Data base and results are an important component in a GIS
- Above all, STA provides a qualitative understanding of how sedimentary environments are “working” from which a large variety of environmental management decisions may be made.